Table 1. MRI Definiation: maximum grades of MRI-detected marginal (4 tibiofemoral locations) osteophytes for knees Kellgren-Lawrence (KL) 0-2

WORMS osteophytes (maximum grades in either central medial/lateral femur/tibia)	KL Grade on X ray		
	0 (N=26) n	1 (N=9) n	2 (N=16) n
0	22 (85%)	1 (11%)	0 (0%)
1	3 (12%)	5 (56%)	2 (13%)
2	1 (4%)	2 (22%)	6 (38%)

4 marginal TF locations using the WORMS scoring system (scale 0-7). All knees KL0-2 were included in the analysis. In our sample, the minimum marginal OP size detected on MRI in KL2 knees was a MRI WORMS grade 1, defined as a tiny or equivocal OP (Table 1). Since radiographically-detectable OPs in KL2 knees are by definition 'definite' OPs, accordingly we defined the MRI grade 1 OP to be the minimum 'definite' OP on MRI. The diagnostic performance of this MRI grade was assessed, using X-ray as the reference. We further evaluated an alternative MRI grading in which 'definite' OPs were defined as a WORMS grade 2. In addition, risk of ROA according to MRI OP grade was assessed using exact logistic model and using the definite MRI OP grade (1) as the reference.

Results: Eighty knees from 40 subjects were imaged. The mean age of subjects was 57 (SD±11) years, 30 (75%) were women, 35 (88%) were white and 31 (78%) had a body mass index ≥25. 26 knees were graded KL0, 9 knees KL1 and 16 KL 2. Of the knees graded as KL2, 2 had a maximum OP size of 1, 3 knees a maximum OP grade 2, 2 knees a maximum OP grade 3 and 9 knees a maximum OP grade ≥4. A grade 1 MRI OP, defined as a "definite" OP, had a sensitivity of 100%, a specificity of 74.3% and an accuracy of 82.3% in diagnosing ROA. Numbers were comparable using a grade 2 OP as a "definite" OP (Table 2).

Table 2. Agreement and diagnostic performance for the presence of radiographic OA (= KL2) of marginal definite MRI osteophytes based on the results of "definite" osteophytes from Table 1

Feature	No. of findings on X ray				Sensitivity (%)	Specificity (%)	Accuracy (%)
	TP	TN	FP	FN			
Maximum WORMS grade 1	16	26	9	0	100	74	82
Maximum WORMS grade 2	14	26	11	0	100	70	78

Abbreviations: TP = true positive; TN = true negative; FP = false positive; FN = false negative.

Risk of ROA increased with increasing OP size albeit not statistically significant due to small sample size (Table 3).

Table 3. Presence of marginal MRI osteophytes and risk of radiographic OA*

MRI Osteophyties (maximum WORMS score inc 4 marginal localtions)	KL Grade		Odds Ratio	p-value
	0 or 1 (N=35) n	2 (N=16) n		
0	23 (68%)	0 (0%)	0.2**	0.17
1	8 (24%)	2 (13%)	1 (reference)	n/a
2	3 (9%)	6 (38%)	7.0	0.11
≥3	1 (3%)	8 (50%)	24.4	0.009

*Knees with a maximum grade 1 of a marginal osteophyte in any of the 4 marginal tibiofemoral locations is defined as "definite" and the reference group.
**Indicated a median unbiased estimate.

Conclusions: A grade 1 MRI OP in any of the 4 TF marginal locations is highly sensitive in diagnosing ROA and shows good specificity. Small (grade 1) MRI-detected OPs show a good diagnostic performance in the detection of ROA and may be defined as "definite" OPs. Further validation in larger studies is needed.

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MEDIAL LATERAL RATIO OF KNEE CONDYLES BONE MINERAL DENSITY IN WOMEN WITH OSTEOARTHRITIC KNEE

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Purpose: We aimed to quantify a subchondral bone sclerosis of the femoral and tibial condyles, and developed medial lateral ratio of bone mineral density (BMD) in patients with varus knee osteoarthritis (OA) using dual energy x-ray absorptiometry (DXA) (CORR 1997). Medial lateral ratio of the knee condyles might have the possibility of monitoring in the progression of varus knee OA. The purpose of this study was to assess the relationship between medial lateral ratio of the knee condyles and various factors.

Methods: This study involved 171 consecutive women with varus knee OA at our institution. The patients were considered to have knee OA if they had Kellgren-Lawrence grades of 2 or higher. In addition, the patients with knee OA showed knee pain during walking, climbing stair and/or descending stair. All patients underwent knee radiograph and DXA at the lumbar spine, proximal femur and knee condyles. Medial and lateral condyle BMDs at the femur and the tibia were measured, and medial lateral ratio of the femoral and tibial condyles were calculated. Anteroposterior and lateral knee radiographs were taken while the patients were in the standing position. The femorotibial (FT) angle was defined as the lateral angle between the femoral and tibial shaft axes, and the femoral condylar-tibial plateau (FCTP) angle was defined as the angle between the tangents to the femoral condyles and the tibial plateau marginal line. Body mass index (BMI) was calculated as an index of obesity. SPSS for Windows was used for statistical analysis. Data were expressed as means ± standard deviations and were assessed using Pearson's correlation coefficient. Significance was set at $p < 0.05$.

Results: The mean age, BMI, FT angle and FCTP angle in women with varus knee OA were 69.6±8.8 years, 25.5±4.2 kg/m^2, 182.6±5.9° and 5.8±3.6°, respectively. The mean medial and lateral condyle BMDs at the femur were 1.195±0.295 and 0.689±0.153 g/cm^2, respectively. Also, the mean medial and lateral condyle BMDs at the tibia were 0.953±0.241 and 0.634±0.142 g/cm^2, respectively. The mean medial lateral ratio at the femur and tibia were 1.79±0.58 and 1.53±0.46, respectively. There were significant association between medial lateral ratio at the femur and medial lateral ratio at the tibia ($r = 0.758$, $p < 0.001$). Medial lateral ratio of the femoral and tibial condyles were significantly correlated with greater FT angle ($r = 0.488$, $p < 0.001$ and $r = 0.547$, $p < 0.001$, respectively). Also, medial lateral ratio of the femoral and tibial condyles were significantly correlated with greater FCTP angle ($r = 0.499$, $p < 0.001$ and $r = 0.591$, $p < 0.001$, respectively).

Conclusions: Medial lateral ratio of the femoral and tibial condyles increased significantly with the progression of varus deformity and joint space narrowing. Medial lateral ratio of the femoral and tibial condyles has the possibility of monitoring in the progression in women with varus knee OA.

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TECHNIQUE FOR DETERMINING OPTIMAL LYON-SCHUSS X-RAY BEAM ANGLE

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Purpose: Development of disease modifying osteoarthritis drugs (DMOAD) need to demonstrate preservation of the joint space width (JSW) which is commonly measured by X-ray. The Lyon-schuss (LS) method of positioning the knee and aligning the X-ray beam so the anterior and posterior tibial margins are aligned on the projection image has been shown to be the most sensitive method for measuring joint space narrowing (JSN). The disadvantage of the LS method is that the optimal beam angle requires the use of fluoroscopy or multiple x-rays and iterating until alignment is obtained. We present a technique for objectively determining the correct LS angle form the first x-ray, allowing a reduction in time and X-ray exposure to the subject.

Methods: This retrospective study used MRI and X-ray from the A9001140 longitudinal knee OA study, to develop and test this method. In this study, the Kellgren and Lawrence (KL)=0 subjects had a body mass index (bmi) < 28 and the OA subjects, KL=2 and 3, had a bmi > 30.From the MRI a 3D reconstruction of the medial tibial plateau was done for 30 female subjects and the plateau width and depth was measured. The ratio of the depth/width was found to be 1.78 (±0.14) and was consistent for KL scores of 0, 2 and 3. The width of the medial tibial plateau was measured on the X-ray and using this ratio the depth of the tibial plateau was estimated. The MRI were only used to establish this ratio and were not required for application of this technique. Using this information, and measuring the inter margin distance (IMD) the correct LS angle was determined using the following method.